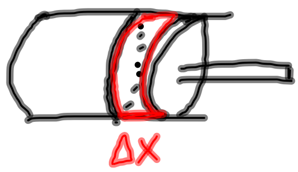
12.



Show $W = \int_{(p_1, V_1)}^{(p_2, V_2)} p \, dv = \int_{V_1}^{V_2} p \, dv$

$F = pA$

a) $\Delta W = F \cdot \Delta X$

$= p A \Delta X$

$\Delta W = p \Delta V$

$W \approx \sum p \Delta V$

$W = \lim_{\Delta V \to 0} \sum p \Delta V$

b $\int_{243}^{32} p \, dv$

i.e. need p in terms of v

$pv^{1.4} = k \quad p = \frac{k}{V^{1.4}}$

$50 \cdot 243^{1.4} = k$

$\int_{243}^{32} \frac{50 \cdot 243^{1.4}}{v^{1.4}} \, dv$

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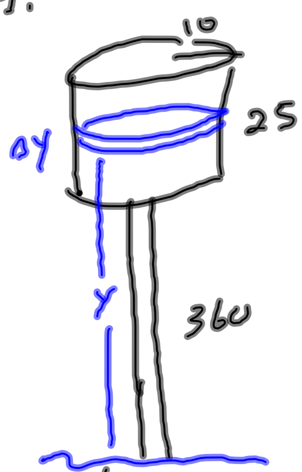
24.



$d = 4 \text{in} = \frac{4}{12} \text{ ft}$

$r = \frac{1}{6} \text{ ft}$

$F \cdot x$

$\Delta W = \text{weight} \cdot y = 62.4 \frac{\text{lb}}{\text{ft}^3} \cdot \Delta V \text{ft}^3 \cdot y$

$\Delta W = 62.4 \pi \cdot 10^2 \cdot \Delta y \cdot y = 100\pi \, 62.4 y \Delta y$

$W_T = \int_{360}^{385} 100\pi \, 62.4 \, y \, dy$

$W_p = \int_0^{360} \left(\frac{1}{6}\right)^2 \pi \, 62.4 \, y \, dy$

$\frac{(W_T + W_p) \text{ ft-lbs } \cancel{\text{sec}} \text{ hr}}{1650 \text{ ft-lbs} \cdot 3600 \text{s}}$

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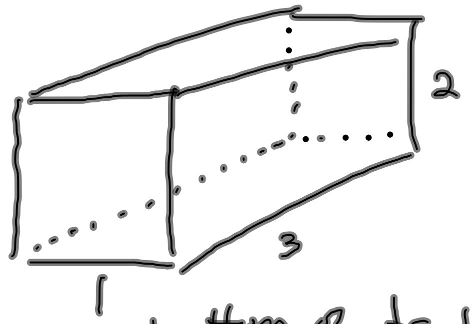
7.5 b Fluid Pressure



filled with water

p = pressure

h = depth

✓ $p = w \cdot h$

w = weight density

for water $w = 62.4\ \text{lb}/\text{ft}^3$

Force on bottom of tank

$p = 62.4\ \frac{\text{lb}}{\text{ft}^3}\ 2\ \text{ft}$

$F = \underbrace{62.4 \cdot 2}_{p}\ \frac{\text{lb}}{\text{ft}^2}\ \underbrace{3\ \text{ft}^2}_{A}$

$= 374.4\ \text{lbs}$

$F = pA$ if p constant

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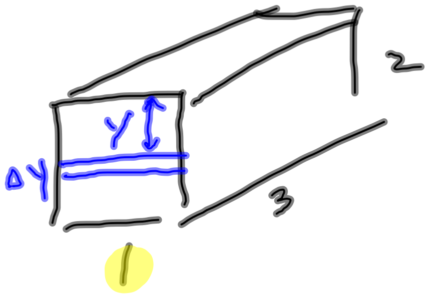

Force on front end

$$F = \int_0^2 62.4\, y\, dy \approx 124.8\ \text{lbs}$$

$\Delta F = p\Delta A$ (force on the strip)

$= w \cdot h \Delta A$

$= 62.4\, y \cdot 1\, \Delta y$

Force on side

$$\int_0^2 62.4\, y \cdot 3\, dy$$

$= 374.4\ \text{lbs}$

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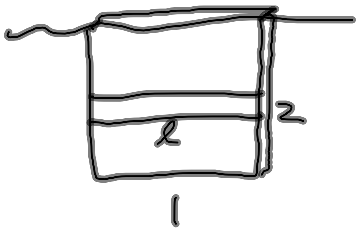
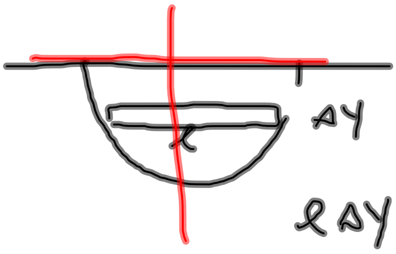


submerge

do same as tank prob.



$l \Delta y = \Delta A$

l is a function of y

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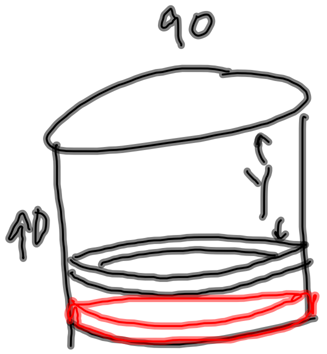

$\Delta F = \rho \Delta A$

$= 100 \cdot y \, 2\pi r \Delta y$ (r = 45)

density of molasses

$\int_0^{90} 100 y \, 2\pi \, 45 \, dy$

bottom strips

$\int_{89}^{90} 100 y \, 2\pi \, 45 \, dy$

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